

[0073]

What is claimed is:

1. A nut-cracking apparatus for cracking nuts comprising:
  - an endless conveyor for delivering nuts to a pickup point, wherein the conveyor is mounted to a plurality of sprockets;
  - a turret rotatably mounted to a frame, the turret comprising a plurality of nut-cracking units, wherein each nut-cracking unit will move past the pickup point as the turret rotates to engage a nut positioned on and carried by the endless conveyor, and wherein the sprockets to which the endless conveyor is mounted rotate in the same direction as the direction of rotation as the turret.
2. The nut-cracking apparatus of claim 1, wherein the endless conveyor rotates about a rear conveyor sprocket and a forward conveyor sprocket, wherein the center of rotation of the forward sprocket lies within a periphery defined by the nut-cracking units.
3. The nut-cracking apparatus of claim 2, the center of rotation of the forward conveyor sprocket being offset from a center of rotation of the turret.
4. The nut-cracking apparatus of claim 2, wherein the forward conveyor sprocket lies completely within the outer periphery defined by the nut-cracking units.
5. The nut-cracking apparatus of claim 1, further comprising an orienting plate positioned over at least a portion of the endless conveyor, the orienting plate having a first end and a second end, the pickup point being located between the first and second ends of the orienting plate.

6. The nut-cracking apparatus of claim 1 further comprising a nut containment area for containing shell fragments and for directing substantially all of the shell fragments along with nuts cracked by the apparatus into a single outlet.

7. The nut-cracking apparatus of claim 6, further comprising:  
a door pivotably attached to the frame, the door movable from an open position to a closed position to cover the turret, wherein the nut containment area comprises first and second ribs attached to the door, wherein each rib has an arcuately shaped edge.

8. The nut-cracking apparatus of claim 7, wherein the arcuate edges of the first and second ribs are generally concentric with the circular periphery defined by the turret.

9. The nut-cracking apparatus of claim 1, the apparatus having a release point at which the nut-cracking unit disengages and releases a cracked nut, wherein the turret rotates through less than 180° from the pickup point to the release point.

10. The nut-cracking apparatus of claim 9, wherein the turret rotates through less than 110° between the pickup point and the release point.

11. A nut-cracking apparatus comprising:
  - an endless conveyor comprising a plurality of nut-transporting units for carrying nuts to a delivery point, the nut-transporting units being mounted to a feed chain, wherein the feed chain engages first and second sprockets; and
    - a rotatable turret mounted to a frame, the rotatable turret comprising a plurality of nut-cracking units, wherein each nut-cracking unit is adapted to engage a nut carried in one of the nut-transporting units and to remove the nut therefrom at the delivery point, wherein the delivery point is located above an axis about which the rotatable turret rotates.
12. The nut-cracking apparatus of claim 11, wherein the nut-cracking unit carries the nut removed from the nut pocket to a release point, wherein the angular distance between the delivery point and the release point is less than 180°.
13. The nut-cracking apparatus of claim 11, further comprising a shell containment area for restricting the dispersion of shell fragments during a nut-cracking operation, and for directing substantially all shell fragments into a single outlet through which cracked nuts are directed.
14. The nut-cracking apparatus of claim 13, the shell containment area being defined by a pair of ribs positioned radially outwardly from a periphery of the turret.
15. The apparatus of claim 13, wherein the shell containment area comprises opposed ribs positioned radially outwardly from the turret, the ribs having an arcuate contour.
16. The apparatus of claim 15, the frame having a door pivotably mounted thereto, wherein the opposed ribs are attached to the door.

17. The nut-cracking apparatus of claim 11, wherein the turret comprises:

- a crack die and shuttle assembly; and
- a cylinder assembly, wherein the endless conveyor travels between the crack die and shuttle assembly and the cylinder assembly.

18. The apparatus of claim 11, further comprising an orienting plate positioned over the nut-transporting units for at least a portion of an upper run of the endless conveyor, the orienting plate covering the delivery point.

19. The apparatus of claim 11, each nut-cracking unit comprising:

- a crack die mounted in the turret; and
- a nut-clamping rod mounted in the turret, the nut-clamping rod being connected to a piston disposed in a nut-clamping cylinder having a first end and a second end, the nut-clamping cylinder defining:
  - a first opening for admitting air into the first end of the nut-clamping cylinder; and
  - a second opening for admitting air into the second end of the nut-clamping cylinder, the turret comprising a rotating valve plate positioned at the second end of the cylinders and spaced therefrom, the rotating valve plate having a plurality of openings through which air is communicated to the first and second openings in the nut-cracking cylinder, and wherein feed air admitted into the second opening causes the nut-clamping rod to move toward the crack die to engage the nut carried by one of the nut-transporting units.

20. The nut-cracking apparatus of claim 19, wherein the plurality of openings in the rotating valve plate comprise a plurality of pairs of openings, each pair of openings being associated with one of the nut-clamping cylinders, and wherein feed air is first admitted through one of the openings in a pair to the second opening in the nut-clamping cylinder to urge the nut-clamping rod into engagement with the nut and to hold the nut between the nut-clamping rod and the crack die, and wherein as the turret rotates additional air is admitted through the same one of the openings in the pair to apply stress to the nut engaged by the nut-clamping rod.

21. The nut-cracking apparatus of claim 20, further comprising means for preventing feed air from escaping from the nut-clamping cylinder prior to the time the additional air is admitted.

22. The nut-cracking apparatus of claim 21, the means for preventing comprising a bushing assembly located adjacent the rotating valve plate, the bushing assembly comprising a feed bushing and a stress bushing connected by a connector plate, the feed and stress bushings comprising spaced feed air and stress air openings, wherein the feed air opening in the bushing assembly admits feed air to the openings in the rotating valve plate and the stress air opening in the bushing assembly admits stress air into the openings in the rotating valve plate as the rotating valve plate rotates relative to the connector being in engagement with the rotating valve plate to prevent feed air from escaping prior to the time stress air is admitted to the nut-clamping cylinder.

23. A nut-cracking apparatus comprising:

    a turret rotatably mounted to a frame, the turret comprising a plurality of circumferentially spaced nut-cracking units;

    an endless conveyor mounted to the frame for delivering nuts from a hopper to a pickup point, the endless conveyor comprising a plurality of nut pockets mounted to a chain; and

    a motor for rotating the turret and for moving the endless conveyor so that the nut-cracking units and nut pockets will align at the pickup point, and wherein each nut-cracking unit will engage a nut carried in a nut pocket at the pickup point and remove the nut from the nut pocket, each nut-cracking unit comprising:

        a crack die; and

        a nut-clamping rod axially opposed from the crack die, the nut-clamping rod being connected to a piston rod disposed in a nut-clamping cylinder and axially movable therein, the nut-clamping cylinder having first and second air openings to admit air into the nut-clamping cylinder, wherein air admitted into the second air opening causes the piston to move toward the crack die so that the nut-clamping rod will engage the nut and hold the nut against the crack die, the turret comprising:

            a rotating valve plate operably associated with the nut-clamping cylinders, the rotating valve plate defining a plurality of openings for admitting air into the first and second air openings in the nut-clamping cylinder; and

            a stationary valve plate, wherein the stationary valve plate defines three passages for admitting air into the openings in the rotating valve

plate, the passages comprising a feed passage, a stress passage and a release passage, wherein feed air is admitted through the feed passage and the rotating valve plate into the second air opening in the cylinder to move the nut-clamping rod into engagement with the nut and to urge the nut into engagement with the crack die, and wherein an additional amount of air is admitted through the stress air passage and the rotating valve plate into the second air opening and nut-clamping cylinder to apply additional pressure to the nut, prior to the feed air from the nut-clamping cylinder being released.

24. The nut-cracking apparatus of claim 23 wherein the stationary valve plate has an inner side and an outer side, the stationary valve plate having a release bushing positioned in a counterbore in the inner side thereof through which release air is communicated to the rotating valve plate, the apparatus further comprising feed and stress valve bushings connected by a connector plate, each being received in a counterbore defined in the inner side of the stationary valve plate, wherein the connector plate is positioned adjacent the rotating valve plate and prevents feed air from escaping from the nut-clamping cylinder prior to the time stress air is admitted.

25. The nut-cracking apparatus of claim 23, further comprising first and second conveyor sprockets about which the endless conveyor moves, the nut-cracking units defining a generally circular periphery, wherein the axis of rotation of the second conveyor sprocket lies within the circular periphery defined by the nut-cracking units.

26. The nut-cracking apparatus of claim 23, each nut-cracking unit further comprising:

a crack die cylinder having a crack die mounted in a first end thereof; and  
a shuttle slidably disposed in the crack die cylinder, wherein air is admitted into one end of the crack die cylinder after stress air has been applied to the nut-clamping cylinder and before release air has been admitted to the nut-clamping cylinder, wherein the shuttle will impact the crack die to crack the nut being held by the nut-cracking unit.

27. The nut-cracking apparatus of claim 26, wherein air is admitted into crack die cylinder at or near the first end thereof to move the shuttle to a reset position after the nut held by the nut-cracking unit has been cracked.

28. The nut-cracking apparatus of claim 23 further comprising an orienting plate positioned over at least a portion of the endless conveyor, wherein the orienting plate overlies the pickup point.

29. The nut-cracking apparatus of claim 23, further comprising a door pivotably connected to the frame and movable between an open and a closed position, the nut-cracking apparatus defining a shell containment area when the door is in the closed position, wherein the shell containment area restricts the spray of shell fragments during cracking and directs substantially all shell fragments along with the cracked nuts into a single outlet.

30. A nut-cracking apparatus comprising:

an endless conveyor movable on a plurality of sprockets, the endless conveyor comprising a plurality of nut pockets mounted to an endless chain for transporting nuts to a pickup point;

a turret rotatably mounted on a frame, the turret comprising a plurality of circumferentially spaced nut-cracking units, each nut-cracking unit comprising:

a crack die mounted at the end of a crack die cylinder, the crack die cylinder having a shuttle slidably disposed therein; and

a nut-clamping rod connected to a piston located in a nut-clamping cylinder, the nut-clamping rod movable between a clamping position and an open position, wherein air admitted to a second end of the clamping cylinder causes the clamping rod to move to the clamping position to engage a nut at the pickup point, and wherein the shuttle impacts the crack die after the nut is clamped to crack the nut; and

a door pivotably attached to the frame and movable between open and closed positions, the apparatus having a shell containment chamber for limiting the spray of shell fragments when a nut is cracked.

31. The nut-cracking apparatus of claim 29, wherein the shell containment chamber is comprised of a pair of spaced-apart ribs attached to the door.

32. The nut-cracking apparatus of claim 30, wherein the ribs are comprised of plastic.

33. The nut-cracking apparatus of claim 30, the containment chamber comprising a pair of opposed ribs positioned to deflect substantially all shell fragments into a single outlet to which cracked nuts are also directed.

34. The nut-cracking apparatus of claim 30, wherein the pickup point is located above the axis of rotation of the turret.

35. The nut-cracking apparatus of claim 30, wherein the endless conveyor is mounted to a rear conveyor sprocket and a forward conveyor sprocket, and wherein the axis of rotation of the forward conveyor sprocket is within a circular periphery defined by the turret.

36. The nut-cracking apparatus of claim 34, wherein the axis of rotation of the forward conveyor sprocket is offset from an axis of rotation of the turret.

37. Apparatus for cracking nuts comprising:

a bin for holding the nuts to be cracked, the bin having a divider plate positioned therein to divide the bin into first and second portions;

an endless conveyor movably disposed about a plurality of sprockets, the endless conveyor comprising a chain and a plurality of nut-transporting units, the endless conveyor having an upper run extending from the bin to a pickup point at which a nut carried by a nut-transporting unit is removed therefrom; and

a deflector plate mounted to the divider plate and positioned over a portion of the upper run of the conveyor to deflect nuts from nut-transporting units so that each nut-transporting unit carries a single nut, the nut-transporting units having a first side and a second side, the first side being adjacent to the divider plate, wherein the deflector plate extends at an angle from the divider plate toward the second side of the nut-transporting units to deflect nuts therefrom.

38. The apparatus of claim 37, wherein the deflector plate angles away from the divider plate at an angle between  $0^\circ$  and  $90^\circ$ .

39. The apparatus of claim 37, the endless conveyor being disposed about a forward conveyor sprocket and a rear conveyor sprocket, wherein the endless conveyor is inclined upwardly from the rear sprocket to the pickup point, and wherein the height of the deflector plate relative to the endless conveyor is adjustable.

40. The apparatus of claim 37 further comprising an orienting plate positioned above and generally parallel to the endless conveyor, the orienting plate being positioned forward of the deflector plate, wherein the orienting plate orients the nuts carried by the nut-transporting units for engagement by a nut-cracking unit which removes the nut from the nut-transporting unit.

41. The apparatus of claim 40, wherein the orienting plate overlies the pickup point.

42. The apparatus of claim 37, further comprising a turret rotatably mounted to a frame, the turret comprising a plurality of nut-cracking units, wherein nuts are removed from successive nut-transporting units by adjacent nut-cracking units as the conveyor moves and the turret rotates.